Chp1: 8, 10, S1.1, 22,26,32,38,42

1.8: $\theta = {\arcsin(\frac{gl}{{\mu_o}^2})}/{2}$

1.10: From B→A : 300m/s, from B→C: 360m/s, from B→D: 329m/s. The differences in speed here are of order ~10%, but since the soundwaves still move very fast, it would be hard to detect with something like stopwatches, but with an oscilloscope hooked up you could easily measure it.

S1.1: (b) A hears sound at t = 0.33s
C hears sound at t = 0.28s
D hears sound at t = 0.30s

(c) All observers will see light flash at the same time.
(d) Since light does not move through a medium, it's velocity, c, is never affected.
(e) Sound waves move with respect to their medium, which can also move. But light doesn't move through a medium.

1.22: 25 years

1.26: (a) gamma = 5/3 (b) $3.0\ x\ 10^{-8}s$ (c) 1000 pions left after d = 36m (d) 100 pions w/o dilation

1.32: length = 21.6m, $t = 9.0x10^{-8}s$, N = 1000 pions

1.38: (a) $\Delta x' = \gamma(\Delta x - v\Delta t)$, same for $\Delta y', \Delta z'$ (b) v = 0.6c , $\Delta x' = -9\ x\ 10^{8}\ m$

1.42: (a) $x_F' = d, t_F' = {d}/{c}, x_B' = -d, t_B' = {d}/{c},$

(b) $x_F = \gamma(x_F' + vt_F') = \gamma(1+\beta)d$

$t_F = \gamma(t_F' + vx_F'/c^2) = \gamma(1+\beta)d/c$

$x_B = \gamma(x_B' + vt_B') = -\gamma(1-\beta)d$

$t_B = \gamma(t_B' + vx_B'/c^2) = \gamma(1-\beta)d/c$

Chp2: None

Chp3: 6, 20d, 24a, S3.1, S3.2, S3.3, S3.4

3.6 (a) 4/3 gram of oxygen (b) 8/3 gram of oxygen

3.20 (d) 1.3 moles in one pound of sugar

3.24 (a) 1.37 x 10^{22} C atoms

S3.1 Answer not given.

S3.2. Answer not given.

S3.3.

S3.4 Answer not given.

Chp4: 4, 12, 16, S4.1, S4.2

4.4: (a) *No answer. Make the substitution. Note: sigma contains an integral.*
(b) *Algebra*
(c) P = 71W

4.12: (a) 650nm (b) 0.6eV

4.16: (a) 25MeV (b) 2.2 x 10^{6} photons / gamma ray photon

S4.1: Answer not given.

S4.2: Answer not given.

S4.3: Answer not given.

Chp5: 12, S5.1, 14, 18, 20, 22, 26, S5.2

5.12: Lyman range: 91nm → 122nm
Balmer range: 365nm → 656nm
Paschen range: 820nm → 1875nm
Brackett range: 1458nm → 4050nm

S5.1:

a. r = 0.0529 nm
b. U = -27.2 eV
c. K = 13.6 eV

d. E = -13.6eV
e. $E_{1\rightarrow 3}$=12.1 eV
f. r = 0.476 nm
g. lambda$_{6\rightarrow 2}$= 409.1 nm (violet)
   lambda$_{2\rightarrow 1}$121.2 nm (UV)

5.14: (a) n =5 (b) n = 17 (c) 3 x 10^{-8} atm

5.18: E = 6.8eV

5.20: (a) r_{pion}=3.2 x 10^{-14} m
(b) Yes, since orbital radius is greater than atomic nucleus radius
(c) r = 2.4 x 10^{-14} m, which is less than the radius of the leads nucleus, so not possible…

5.22: m = 4.96 x 10^{7} $\sqrt{Hz}$

5.26: (a) 5.4 fm, this is 207 times smaller than the orbital radius of the innermost electrons, so there is little effect from the electrons on the pion
(b) E = 4.66MeV, wavelength = 266 fm

S5.2

c. Orbital radius is about the same size as nucleus, so yes.
d. About zinc (Z = 30)
e. The particle needs a larger mass than the muon

Chp6: 12, S6.1, 22, S6.2, 26, 32, S6.3, 48

6.12: (a) *No answer.*
(b) *No answer.*

S6.1

$\lambda_{3eV\ photon}$= 413.3 nm
$\lambda_{3eV\ electron}$= .708 nm
$\lambda_{2MeV\ photon}$= 620 fm
λ_{2MeV} electron= 642.5 fm

S6.2 E (1nm, 1ns) = -0.52 E_0

6.26: (a) and (b) *No answer, hint: v = dx/dt*

6.32 *No answer, another "show that" problem.*

S6.3

a.
   $A_1 = 0.651$
   $A_2 = 0.276$
   $A_3 = 0$
   $A_4 = -0.138$
   $A_5 = -0.110$

b. *Screenshot*

c. *Explain*

6.48: (a) $\Delta E = 3.3\ x\ 10^{13} eV$
(b) $\Delta\lambda\ 8\ x\ 10^{-11} nm, {}^{\Delta\lambda}/_{\lambda} = 1.5\ x 10^{-13}$

Chp7: S7.1, 10, 12, 14, 20, S7.2, 26, 30, 34, S7.3

S7.1 Answer not given.

7.9: Answer not given.

7.10: *No answer*

7.12: (a) z = r(cos(wt)-isin(wt)), where x = rcos(wt) and y = rsin(wt) which are 90 degrees out of phase.
(b) |z|= r = constant

7.14: *No answer*

7.20: *Sketch, no answer*

S7.2: Answer not given.

7.26: (a) *No answer, just differentiate each twice*
(b) *No answer, use Euler's relation*

7.30: (a) $|\psi_3(x)|^2 = {}^{2}/_{a}\, sin^2({}^{3\pi x}/_{a})$ *Sketch not shown.*

(b) a/6, a/2, 5a/6

(c) 2% and 1%

7.34: $< x > = a/2$

S7.3: Answer not given

Chp7: 40, 42, 44, 50

7.40: *Sketch not shown.*

7.42: *Sketch not shown.*

7.44: (a) *No answer.*
(b) *Sketch not shown.*

7.50: *Do the integral, solve for A_0*

Chp 8: 10, 20, S8.1, 36, S8.2, 38a

8.10:

N_x	N_y	E/E_0	Degeneracy
3	2	25	1
2,4	2,1	20	2
1	2	17	1
3	1	13	1
2	1	8	1
1	1	5	1

8.20: *No answer. Draw a picture, derive the expressions.*

S8.1: If you get 1 for the normalization integral, then it is normalized.

8.36: (a) $L = \sqrt{l(l+1)}\hbar$

(b) $E = -E_R/n^2$ with n = l+1, l+2,…

S8.2: answer not given

8.38 (a): Three possible states.

Chp8: 40, S8.3, 42, S8.4, 52

8.40: (a)

$$\frac{d^2}{dr^2}(rR) = \left(\frac{-2}{ar} + \frac{n(n-1)}{r^2} - \frac{2mE}{\hbar^2}\right)(rR).$$

(b) *No answer shown.*

S8.3: Answer not given.

8.42: $\langle r \rangle = 1.5a_B$

S8.4: $r = a_B$

8.52: (most probable) radius = 0.6 pm. (binding energy) E = 91 KeV